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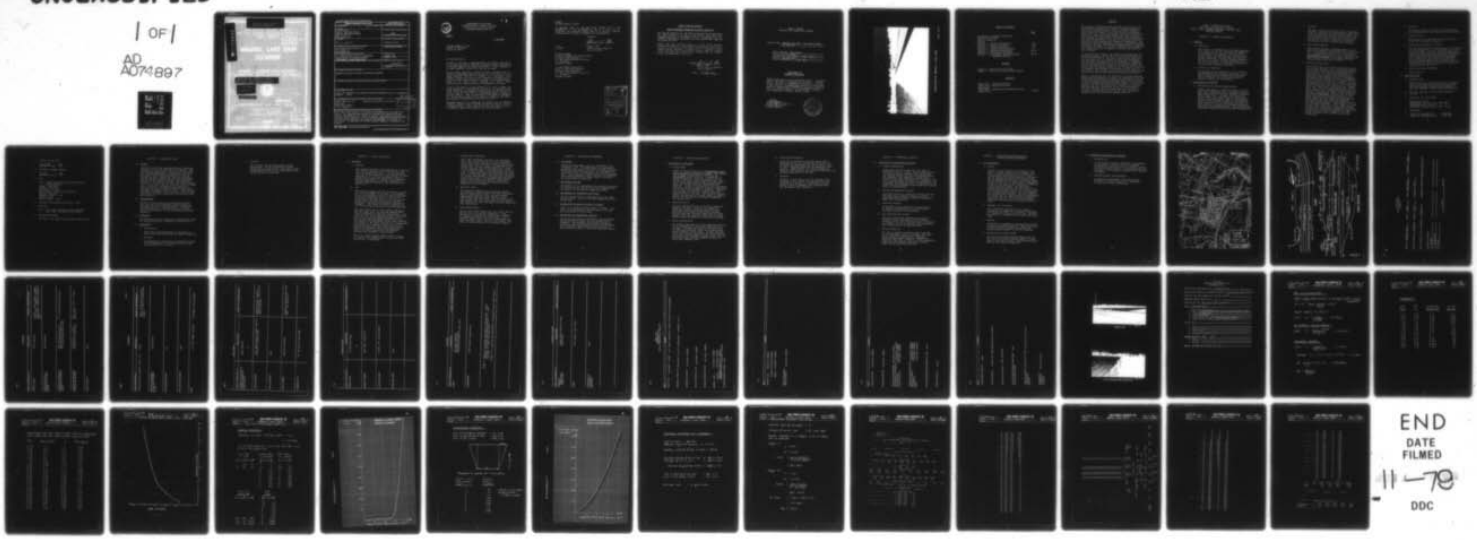

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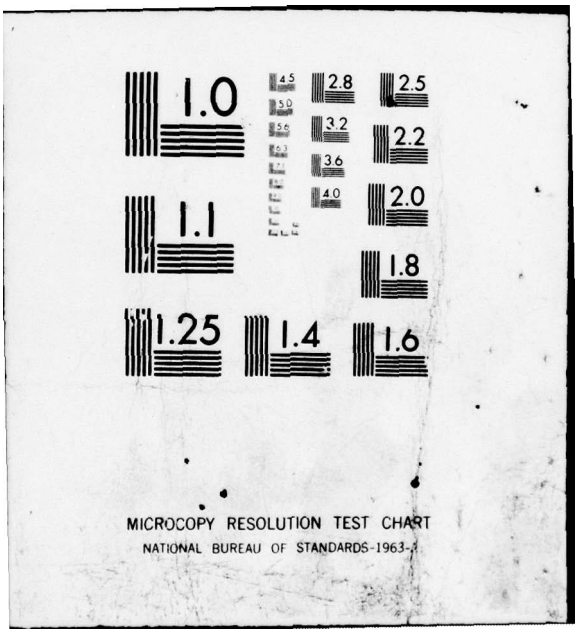
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Waddill Lake Dam (NJ-00097). Atlantic Coast Basin. Kettle Creek, Ocean County, New Jersey. Phase 1 Inspection Report.

(9) Final rept.,

F. Keith /Jolls
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(5) DACW61-79-C-0011

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NJ00097	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report National Dam Safety Program Waddill Lake Dam Ocean County, N.J.		5. TYPE OF REPORT & PERIOD COVERED FINAL 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Jolls, F. Keith P.E.		8. CONTRACT OR GRANT NUMBER(s) DACW61-79-C-0011 new
9. PERFORMING ORGANIZATION NAME AND ADDRESS Louis Berger & Associates, Inc. 100 Halstead St. East Orange, N.J.		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, Philadelphia Custom House, 2d & Chestnut Streets Philadelphia, Pennsylvania 19106		12. REPORT DATE August, 1979 13. NUMBER OF PAGES 55
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Waddill Lake Dam, N.J. National Dam Inspection Act Report
Spillways
Structural Analysis
Visual Inspection

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

27 SEP 1979

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, NJ 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Waddill Lake Dam in Ocean County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, *Waddill Lake Dam*, initially listed as a high hazard potential structure but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in excellent overall condition and the spillway is considered adequate. Based on the dam's overall condition and reduced hazard classification, no remedial actions are recommended at this time.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Edwin B. Forsythe of the Sixth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-D
Honorable Brendan T. Byrne

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

WADDILL LAKE DAM (NJ00097)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 2 May 1979 by Louis Berger and Associates, Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Waddill Lake Dam, initially listed as a high hazard potential structure but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in excellent overall condition and the spillway is considered adequate. Based on the dam's overall condition and reduced hazard classification, no remedial actions are recommended at this time.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 27 Sep 1979

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam Waddill Lake Dam Fed ID# NJ 00097
NJ ID# 563

State Located New Jersey
County Located Ocean
Coordinates Lat. 4003.0 - Long. 7410.7
Stream Kettle Creek
Date of Inspection 2 May 1979

ASSESSMENT OF GENERAL CONDITIONS

Waddill Lake Dam is in an excellent overall condition and the spillway is adequate to transmit the design flood. The dam is recommended to be downgraded from a high hazard to a significant hazard as overtopping would not appreciably increase the danger of loss of life or property damage. No detrimental findings were uncovered to warrant further study.

F. Keith Jolls P.E.
Project Manager

OVERVIEW OF WADDILL LAKE DAM

MAY, 1979

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM: WADDILL LAKE DAM FED #NJ 00097
AND NJ ID #563

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with Contract FPM-36 between Louis Berger & Associates, Inc. and the State of New Jersey and its Department of Environmental Protection, Division of Water Resources. The State, in turn, is under agreement with the U.S. Army Corps of Engineers, Philadelphia to have this inspection performed.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the Waddill Lake Dam and appurtenant structures, and to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

Waddill Lake Dam is an 800 foot long, 12.5 feet high earth embankment with a corrugated metal drop-inlet riser and 48-inch diameter corrugated metal outlet pipe. The dam crest, which is 60 feet wide, is protected by a 4-lane paved street, Buckingham Road. There is a depressed section of the roadway beyond the left abutment which could serve as an auxiliary spillway. It also contains a system of perforated toe drains located in the downstream toe. The upstream and downstream slopes are 3H:1V and 2H:1V respectively.

b. Location

The dam is located on Kettle Creek in Lakewood Township, Ocean County approximately three miles south of Lakewood. The dam lies generally in a north-south orientation on Kettle Creek 400± feet upstream from its confluence with Green Branch and is roughly 3000 feet southwest of interchange 88 on the Garden State Parkway.

c. Size Classification

Lake Walkill dam has a maximum height of 12.5 feet and a maximum storage capacity of 935 acre-feet. Accordingly, this dam is in the small size category as defined by the criteria in the Recommended Guidelines for Safety Inspection of Dams (storage between 50 and 1000 acre-feet, maximum height less than 40 feet).

d. Hazard Classification

This dam is part of a three-lake system within the Leisure Village senior retirement community and is constructed at the easterly edge of the development. The downstream floodplain for about one mile is low-lying marshland and is completely undeveloped within the floodplain. The Garden State Parkway crosses the floodplain 1500 feet below the dam but is elevated 20 to 30 feet above the flow line. However, further downstream Kettle Creek flows into Irisado Lake before discharging into Barnegat Bay. Because there are a few homes (surrounding the latter lake) that might be endangered should the study dam collapse, the recommended hazard classification is significant. Most of the residential development surrounding Irisado Lake is well above the potential flooding elevation but a small number of homes might be endangered notwithstanding that the extensive upstream floodplain would absorb a considerable portion of a collapse discharge. Also, there is a high voltage line to the west of the Garden State Parkway which crosses the floodplain and three of the steel transmission towers are within the floodplain and could be damaged if a large amount of debris were trapped against the foundations.

e. Ownership

This dam is owned by Original Leisure Village, 19 Buckingham Drive, Lakewood, New Jersey, 08701.

f. Purpose of Dam

The purpose is to impound a recreational lake within the retirement community.

g. Design and Construction History

The dam was designed in 1963 by Erwin V.D. Wallace, P.E. for Robilt Inc., the developers of Original Leisure Village. Frank H. Lehr Associates reviewed the foundation and materials investigation and prepared the construction specifications for the dam which was completed in September 1963. Donald W. Smith, P.E. inspected and reported on dam modifications in April 1968 and his consulting firm is presently in charge of engineering for the owner.

h. Normal Operating Procedures

See Section 4.

1.3 PERTINENT DATA

a. Drainage Area

Waddill Dam has a drainage area of 3.0 square miles which consists of gently sloping woodland and suburban residential development. The area includes several small upstream dams.

b. Spillway capacity at top of dam elevation - 147 cfs

c. Elevation (ft. above MSL)

Top of dam - 42.5
Maximum design pool - 40.3 (Dam Appl.)
Recreation pool - 37.08
Streambed at centerline of dam - 30.0±

d. Reservoir

Length of maximum pool - 3700 feet
Length of recreation pool - 2900 feet

e. Storage (acre-feet)

Top of dam - 935
Recreation pool - 200

f. Reservoir Surface (acres)

Top dam - 229
Recreation pool - 32

g. Dam

Type - Earth with drop inlet and low-level drop spillway.
Length - 800 feet
Height - 12.5 feet
Top Width - 60 feet
Side Slopes - 3H:1V U/S, 2H:1V D/S
Zoning - Unzoned
Impervious Core - None
Cutoff - None
Grout curtain - None

h. Diversion and Regulating Tunnel - None

i. Spillway

Type - 48" C.M.P. sluiceway with two-stage drop inlet and anti-vortex cover.

j. Regulating Outlets

24" vert. lift Armco gate at base of drop inlet

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The plans and design computations were available relating to the original 1963 construction. The engineering design by Mr. Frank H. Lehr PE #9060 was reviewed regarding the embankment stability. Mr. Lehr's report delved extensively into the foundation soils conditions, flow net analyses, and the seepage, piping, sliding and overturning aspects of the original design. The principal feature of this dam is its very wide cross section (115' at the base) and its lack of a clay or timber core. The site is underlaid with stratified variable deposits of gravel, sand and silt with the depth to bedrock over 100 feet. Augur borings indicated a medium to fine sand with 5 to 20% silt and traces of gravel typical of the alluvial Cape May formation.

2.2 CONSTRUCTION

Nothing is known about the construction except that the work was accomplished substantially in accordance with the contract plans. It appears the work was done in conjunction with the sub-division development of the surrounding retirement community.

2.3 OPERATION

The dam appears to be operating satisfactorily from an engineering design standpoint (see Section 4).

2.4 EVALUATION

a. Availability

Sufficient engineering data is available to fully assess all aspects of the design stability.

b. Adequacy

The adequacy of the design is believed to allow a full assessment of the safety aspects under the purview of P.L. 92-367.

c. Validity

The validity of the design plans is not questioned. The work undertaken appears satisfactorily engineered in the view of the inspection team and is not challenged insofar as the design is concerned.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

The visual inspection was conducted on 2 May 1979 and revealed the dam to be in excellent condition and discharging about a 30 inch depth of flow out of the sluiceway. All aspects reviewed appeared to be in close conformity with the design plans except the depth of the auxiliary spillway delineated in the dam application appears somewhat shallower than designed (see Section 5).

b. Dam

The asphalt roadway over the crest has its high point in the middle of the dam. The pavement is in good condition with no visible settlement, cracks, or subsurface failure. Due to the longitudinal vertical curve, there are no curb inlets within the dam area and all surface drainage is carried longitudinally beyond the abutments. The crest is further protected by a 4 foot concrete sidewalk on the upstream edge.

The side slopes are at true grade as designed and the upper zones are heavily grassed with visible evidence of excellent maintanence. The lower portion of the upstream slope is protected with 1½ to 2½ inch crushed bluestone and a narrow berm has been added several feet below the crest on the downstream slope and is planted with shrubs. The plans indicate 12" intercepting toe drains are installed at the base of the downstream slope but the outlets could not be found. A high water table or outflow from a curb storm drain beyond the left abutment obscures any evidence of percolation.

There is a small Jersey Central Power & Light Co. transformer station and a chain link fence located on the backslope.

c. Appurtenant Structures

The single discharge spillway is a two-stage drop inlet consisting of a 72 inch corrugated metal riser with a corrugated steel anti-vortex shield and a debris screen. The horizontal discharge pipe is a 48" asphalt-coated C.M. pipe. At the upstream face of the drop inlet, there is a 24" low-level intake (for dewatering the lake) with an Armco slide gate affixed inside the riser pipe. All exposed metal that could be inspected is coated with asphalt or painted and only minor rusting was noted. The expanded metal debris screen could severely block the intake but it appears to be constantly maintained and was completely free of debris.

d. Reservoir Area

The shores of Waddill Lake are gently sloped and completely grassed over with well maintained lawns. There are two small (5± acre) lakes immediately upstream on the Tarkiln Branch; Lake Windsor and Lake Devon. Both are only a few feet higher that the normal pool at Lake Waddill. The reservoir is clean of debris and the shorelines well stabilized.

e. Downstream Channel

Kettle Creek flows almost due east after passing the dam in a flat marshy floodplain. Just before passing under the Garden State Parkway, it crosses a transmission line where it has recently washed out a culvert on the power company inspection road. East of the Parkway, the creek is well-confined in its natural channel.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Operational procedures were not observed by the inspection team. The embankment and appurtenant structures are part of the owner's normal operation and maintenance responsibility, but no manuals or instructions for the regulation of flow were available. The community's staff regulate the reservoir level during periods of heavy runoff, utilizing the sluice gate as required.

4.2 MAINTENANCE OF DAM

Maintenance of the embankment and spillway structure is carried out by the full-time crews employed by the owner for the overall community upkeep.

4.3 MAINTENANCE OF OPERATING FACILITIES

The 24" sluice gate was repaired during the 1968 rehabilitation. This is the only operating device on the dam.

4.4 DESCRIPTION OF WARNING SYSTEM IN EFFECT

There is no formal warning system in effect. However, the maintenance personnel monitor the dam during periods of heavy flow.

4.5 EVALUATION OF OPERATIONAL ADEQUACY

The present operational procedures and safeguards during periods of heavy flow are deemed to be adequate. The community maintenance personnel diligently pursue monitoring activities and reservoir regulation during heavy storms as well as maintaining the dam in a state of excellent repair.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

Based on the criteria in the Recommended Guidelines for Safety Inspection of Dams, Lake Waddill Dam is small in size and is placed in the significant hazard category. Accordingly, a 100-year frequency event was selected as the design storm and a inflow hydrograph was calculated using precipitation data from Technical Paper 40 and NOAA Technical Memorandum NWS Hydro-35. Inflow to the reservoir was calculated utilizing the HEC-1 computer program, discharging a peak into the reservoir of 5004 cfs. Routing this through the reservoir reduced the peak significantly to 143 cfs. The spillway capacity before overtopping of the dam occurs is approximately 147 cfs and can therefore accommodate the design flood.

b. Experience Data

Original design data was availabile concerning Waddill Lake Dam. However, the hydraulic/hydrologic analysis appended was done independently using Corps of Engineers criteria. The spillway was originally designed to accommodate a 50-year frequency event with the additional safety feature of an auxiliary spillway.

c. Visual Observations

The design plans call for this auxiliary spillway to be constructed in Buckingham Road north of the dam. Although this area is slightly lower, its hydraulic efficacy could not be determined without precise field survey. As both abutment zones are slightly lower than the center portion of the dam, any overtopping flows would initially discharge there and most probably around the lower left abutment zone.

d. Overtopping Potential

There are no records of the dam having been overtopped since its installtion and since the spillway can accommodate the design flood, there is only a marginal potential for damaging overtopping. Additionally, any true overtopping would be alleviated by the slightly lower auxiliary spillway area north of the dam.

e. Drawdown

Drawdown is provided by the 24" diameter blow-off pipe with an invert at elevation 30.0 and assuming no tailwater, it would take approximately 6 days to drawdown the reservoir from the recreation pool elevation.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Based upon existing conditions, the dam is evaluated to be in a safe, stable configuration with all principal elements well maintained. The roadway surface run-off is directed beyond the abutments into adequately spaced catch basins by the curbs and there is no evidence that it is overtopping or scouring the sideslopes. The embankment is extremely wide in comparison to its height and was thoroughly engineered and reviewed prior to construction.

b. Design and Construction Data

Reviewing Section 2, sufficient design data was available of an adequate nature to allow a valid assessment without recourse to gathering additional information.

c. Operating Records

No records are available but the dam appears to function satisfactorily as there are no recorded instances of overtopping.

d. Post-Construction Changes

The only recent post construction change in evidence is the construction of the narrow planting berm on the downstream slope. According to records, the top of spillway was raised one foot shortly after the dam was built.

e. Seismic Stability

The dam is located in Seismic Zone 1 and due to its embankment width vs. height, has negligible potential vulnerability regarding potential earthquake loadings. Experience indicates that dams in Zone 1 will have adequate stability under dynamic loadings if stable under static loading conditions.

SECTION 7 - ASSESSMENTS/RECOMMENDATIONS/ PROPOSED REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

Subject to the inherent limitations of the Phase I visual inspection, the Waddill Lake Dam is classified as being in a sound and satisfactory structural condition. The spillway is capable of passing the design flood. The dam embankment was built of unknown composition but due to its broad width, impermeable condition and lack of any evidence of seepage, is felt to be sufficient to withstand normal hydraulic heads. The dam is well-maintained and monitored by the grounds forces of Original Leisure Village, Inc. who perform all as-needed maintenance. The only elements that could not be inspected were the perforated toe drains but the lack of evident discharge from their outlets (by the main sluiceway) indicates they are above the present phreatic line.

b. Adequacy of Information

The information gathered for the Phase I inspection is deemed to be adequate regarding the structural stability of the dam. However, no surveys or inspections have been made since 1968.

c. Urgency

No urgency is attached to implementing further studies or remedial measures. The owner might be advised that periodic inspections are required under present Title 58:4 Statutes.

d. Necessity for Further Study

In view of the hazard classification and the fact that no serious property damage is foreseen in case of a failure, further engineering studies are deemed unnecessary.

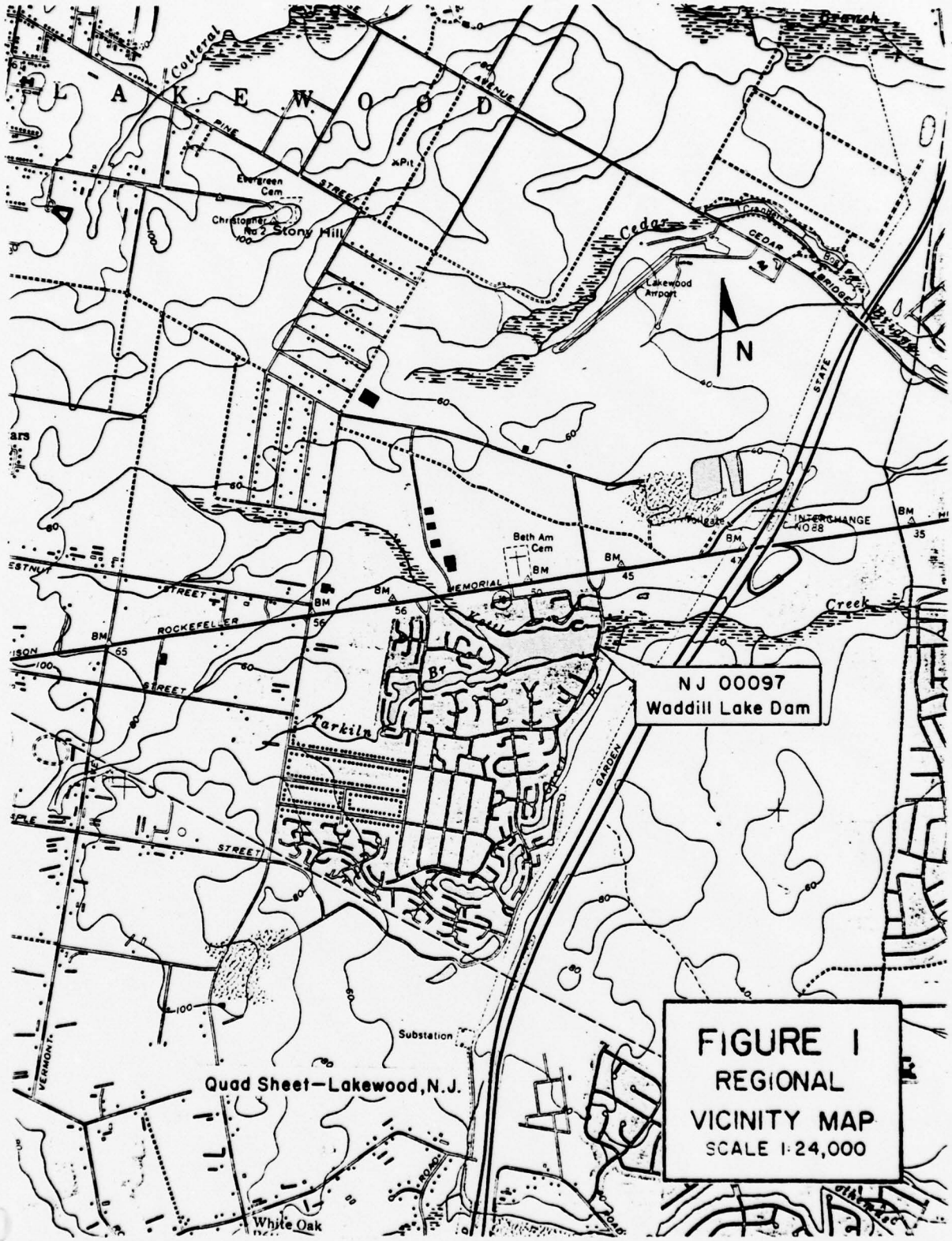
7.2 RECOMMENDATIONS/REMEDIAL MEASURES

a. Alternatives

On the basis of visual inspection, improvements to the present spillway are not warranted. Consideration could be given to slightly raising the vortex shield (which is constructed atop the spillway) if the hydraulic capacity ever becomes a problem.

b. O&M Maintenance and Procedures

No additional procedures other than those presently in effect appear to be warranted in view of the above assessment.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Collerai
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Lakewood Airport
N
STATE
Beth Am Cem
MEMORIAL
ROCKEFELLER
STREET
Creek
Br
Parkin
GARDEN
INTERCHANGE NO 88
NJ 00097
Waddill Lake Dam
Substation
VERMONT
Quad Sheet—Lakewood, N.J.
White Oak
FIGURE 1
REGIONAL
VICINITY MAP
SCALE 1:24,000

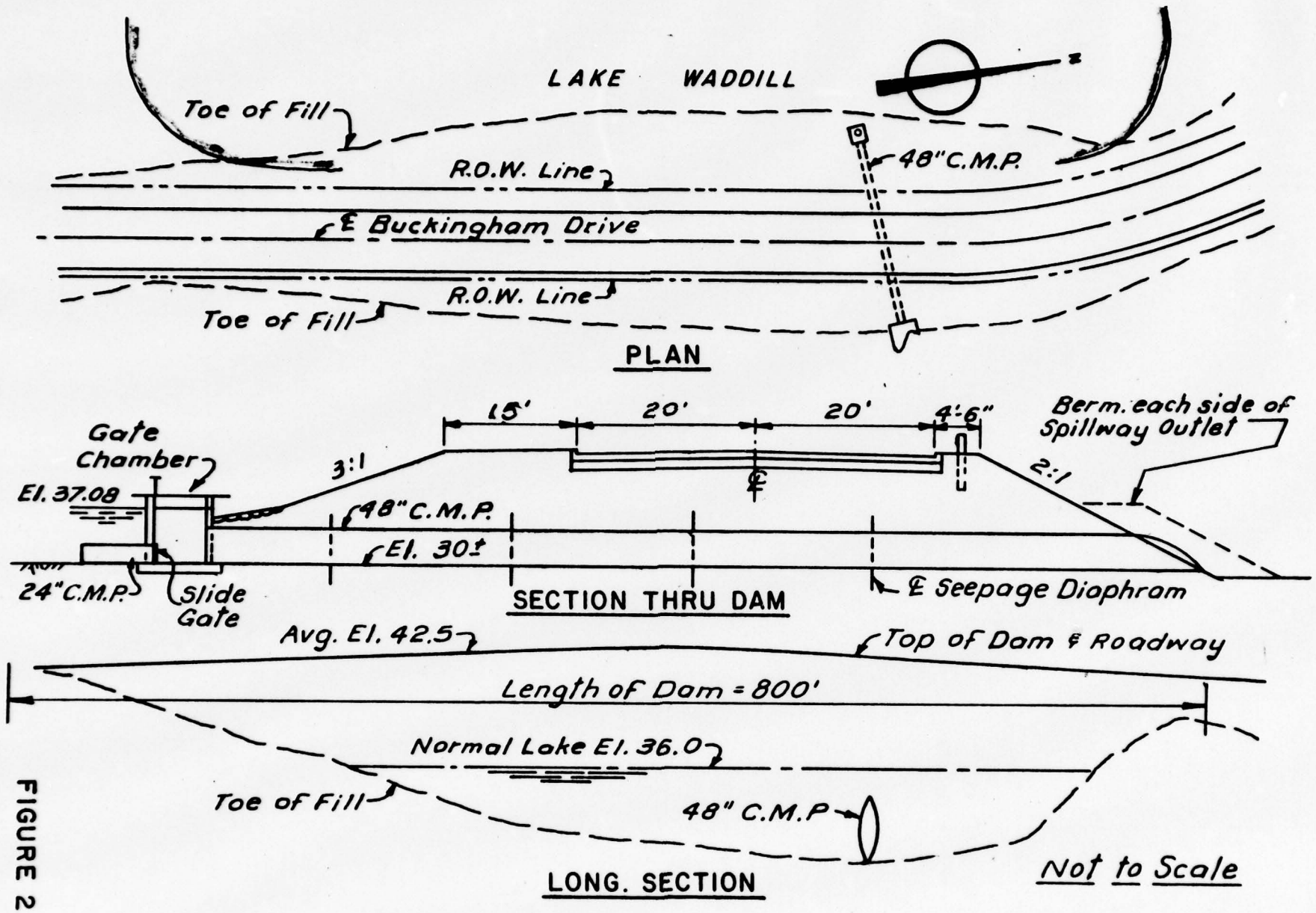

LAKE WADDILL
Toe of Fill
R.O.W. Line
℄ Buckingham Drive
R.O.W. Line
Toe of Fill
48" C.M.P.
PLAN
15'
20'
20'
4'-6"
Berm each side of Spillway Outlet
Gate Chamber
El. 37.08
3:1
2:1
48" C.M.P.
El. 30±
24" C.M.P.
Slide Gate
℄ Seepage Diaphram
SECTION THRU DAM
Avg. El. 42.5
Top of Dam & Roadway
Length of Dam = 800'
Normal Lake El. 36.0
Toe of Fill
48" C.M.P.
LONG. SECTION
Not to Scale

FIGURE 2

Check List
Visual Inspection
Phase 1

Name Dam Waddill Lake County Ocean State New Jersey Coordinators NJDEP

Date(s) Inspection 2 May 79 Weather Clear Temperature 61°

Pool Elevation at Time of Inspection 37.08 M.S.L. Tailwater at Time of Inspection 32.5 M.S.L.

Inspection Personnel:

L. Baines

K. Greenfield

K. Jolls

K. Jolls Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	Curbed, 2 lane asphalt roadway over crest. Roadway crowned at centerline of dam: no curb inlets
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None. Lower portion of upstream face covered with 1½" stone(under water line)	All slopes heavily grassed
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Satisfactory - approximately 50' crest width.	Water level about 7' below dam crest.
RIPRAP FAILURES	None.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
Excessive shrub growth, trees, etc.	None	Small shrubs planted along security fence on downstream slope.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Satisfactory	
ANY NOTICEABLE SEEPAGE	No	
STAFF GAGE AND RECORDER	None	
DRAINS	12'' Perf. Accmp. toe drains	No evidence of any discharge.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed	
INTAKE STRUCTURE	7'x7' drop inlet (4 sided opening) On top of 72" vertical riser.	Expanded metal severely blocks intake. Debris will easily plug up.
OUTLET STRUCTURE	None	
OUTLET CHANNEL	Natural streambed	Appears to be 48" CMP outlet pipe. (No head wall).
EMERGENCY GATE	24" lift gate in riser intake.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	See previous page.	
APPROACH CHANNEL	None (Main Reservoir)	
DISCHARGE CHANNEL	Narrow, 20' clear channel	
BRIDGE AND PIERS	None	

(9)

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Flat-well grassed. Man-made shore line. Surrounding homes at dam crest.	
SEDIMENTATION	None (recent construction)	

NOTE: 1) There is a new dam upstream at Lake Windsor. Small spillway structure and footpath bridge. 8' wide spillway. 8' drop into main lake.

2) There is a smaller dam upstream at Huntington Drive (Lake Devon)

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Garden State Parkway bridge downstream.	
SLOPES	Flat marshy tidal flats.	
APPROXIMATE NO. OF HOMES AND POPULATION	None	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available (NJDEP - Div. Water Resources, Bureau Flood Plain Management)
REGIONAL VICINITY MAP	Available (U.S.G.S. Quadrangle - Lakewood, N.J.)
CONSTRUCTION HISTORY	Available (NJDEP)
TYPICAL SECTIONS OF DAM	Available (NJDEP)
HYDROLOGIC/HYDRAULIC DATA	Available (NJDEP)
OUTLETS - PLAN	Available (NJDEP)
- DETAILS	Available (NJDEP)
-CONSTRAINTS	Available (NJDEP)
-DISCHARGE RATINGS	Available (NJDEP)
RAINFALL/RESERVOIR RECORDS	None

ITEM	REMARKS
SPILLWAY PLAN	Available (NJDEP)
SECTIONS	Available (NJDEP)
DETAILS	Available (NJDEP)
OPERATING EQUIPMENT PLANS & DETAILS	Available (NJDEP)

ITEM	REMARKS
DESIGN REPORTS	Available (NJDEP)
GEOLOGY REPORTS	Available (NJDEP)
DESIGN COMPUTATIONS	Available (NJDEP)
HYDROLOGY & HYDRAULICS	Available (NJDEP)
DAM STABILITY	Available (NJDEP)
SEEPAGE STUDIES	Available (NJDEP)
MATERIALS INVESTIGATIONS	Available (NJDEP)
BORING RECORDS	Available (NJDEP)
LABORATORY	Available (NJDEP)
FIELD	Available (NJDEP)
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	Known

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Record of 1968 modification available
HIGH POOL RECORDS	None available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	No record of failure
MAINTENANCE OPERATION RECORDS	None available

May, 1979

Waddill Lake

May, 1979

View of Upstream Slope Looking North

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 3 square miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 37.08 M.S.L. (200 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): _____

ELEVATION MAXIMUM DESIGN POOL: _____

ELEVATION TOP DAM: 42.5 M.S.L. (935 acre-feet)

CREST: Main Spillway

a. Elevation 37.08 M.S.L.
b. Type Circular drop inlet with corrugated metal riser
c. Width 12 gage CMP
d. Length 18.8 feet
e. Location Spillover 120 feet from left abutment
f. Number and Type of Gates 1-24" blow-off gate

OUTLET WORKS: _____

a. Type _____
b. Location _____
c. Entrance inverts _____
d. Exit inverts _____
e. Emergency draindown facilities _____

HYDROMETEOROLOGICAL GAGES: None

a. Type _____
b. Location _____
c. Records _____

MAXIMUM NON-DAMAGING DISCHARGE: 147 cfs

BY D.J.M. DATE 6-79 | **LOUIS BERGER & ASSOCIATES INC.** | SHEET NO. A1 OF
CHKD. BY DATE | WADRILL LAKE DAM | PROJECT C.234
SUBJECT

Time of concentration :

length along water course to drainage divide = 2 miles
= 10,560 feet

$\Delta H = 90'$ Slope $= \frac{90 \times 100}{10,560} = 0.85\ \%$

Assume velocity of 2 feet s^{-1}

gives: $t_c = \frac{10,560}{2 \times 3600} = 1.47$ hours

By California Culverts Method :

gives: $t_c = \left(\frac{11.9 \times 2^3}{90}\right)^{0.385} = 1.02$ hours

Alternative method :

gives: $t_c = \frac{10560^{1.15}}{7700 \times 90^{0.38}} = 1.0$ hours

Average $t_c = (1.0 + 1.02 + 1.47)/3 = 1.16$ hours

$t_p = \frac{0.25}{2} + 0.6 \times 1.16 = 0.83$ hours

$Q_p = \frac{484 \times 3}{0.83}$

BY D.J.M. DATE 6-79
CHKD. BY _____ DATE _____
SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.
WADDILL LAKE DAM

SHEET NO. A2 OF
PROJECT C.234

Unitgraph :

Time (hours)	T/Tp	Dimensionless Ordinate (DO)	Q (cfs) = Qp x DO
0.25	0.30	0.16	281
0.50	0.60	0.60	1053
0.75	0.91	0.98	1720
1.00	1.21	0.91	1597
1.25	1.51	0.65	1141
1.50	1.81	0.41	720
1.75	2.12	0.27	474
2.00	2.42	0.17	298
2.25	2.72	0.11	193
2.50	3.02	0.07	123
2.75	3.32	0.047	83
3.00	3.63	0.030	53
3.25	3.93	0.020	35

BY D.J.M. DATE 6-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A3 OF
CHKD. BY DATE SOUTH GROUP DAMS PROJECT 234
SUBJECT

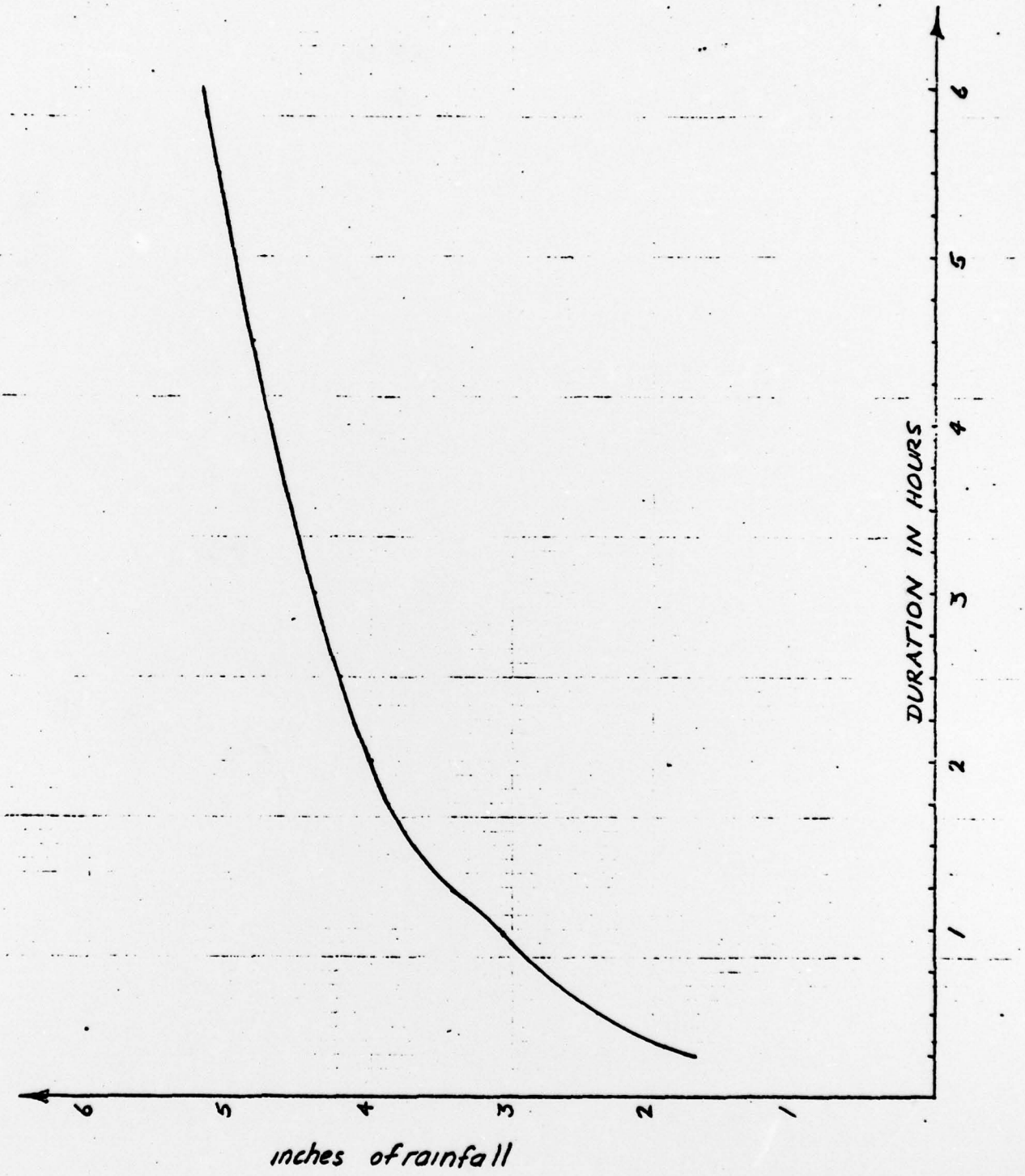
Precipitation data from T.P. 40 & NOAA Technical Memorandum NWS HYDRO-35 (See depth duration curve overleaf)

Time	Precipitation	Δ	Rearrange Δ
0.25	1.7	1.7	0.06
0.50	2.4	0.7	0.06
0.75	2.8	0.4	0.06
1.00	3.1	0.3	0.07
1.25	3.4	0.3	0.08
1.50	3.7	0.3	0.09
1.75	3.86	0.16	0.11
2.00	4.00	0.14	0.14
2.25	4.11	0.11	0.30
2.50	4.22	0.11	0.30
2.75	4.31	0.09	0.70
3.00	4.40	0.09	1.70
3.25	4.49	0.09	0.40
3.50	4.57	0.08	0.30
3.75	4.64	0.07	0.16
4.00	4.71	0.07	0.11
4.25	4.78	0.07	0.09
4.50	4.84	0.06	0.09
4.75	4.90	0.06	0.07
5.00	4.96	0.06	0.07
5.25	5.02	0.06	0.06
5.50	5.08	0.06	0.06
5.75	5.14	0.06	0.06
6.00	5.20	0.06	0.06

BY D.J.M DATE 1-79 SUBJECT SHEET NO. A4 OF

CHKD. BY DATE DEPTH DURATION CURVE JOB NO. C227

T.P. 40 & NOAA Tech. Memo NWS - HYRO 35



BY D.J.M. DATE 6-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A5 OF
CHKD. BY DATE WARDILL LAKE DAM PROJECT C234
SUBJECT Spillway discharge capacity

Spillway discharge:

Effective perimeter of drop inlet = $\pi \times 6$

$\approx$ 18.8 feet

due to trash rack, use $c = 2.9$ for weir flow and $c = 0.5$ for culvert flow

Weir flow
$L = 18.8'$

H	c	Q
0		
1	2.9	55
1.5	2.9	100

Culvert flow
$A = 28.2 ft^2$

H	Q
0	0
1	0
1.5	0
2	160
3	196
4	226
5	253
6	277
7	299
8	320

Pipe flow
$A = 12.6 ft^2$

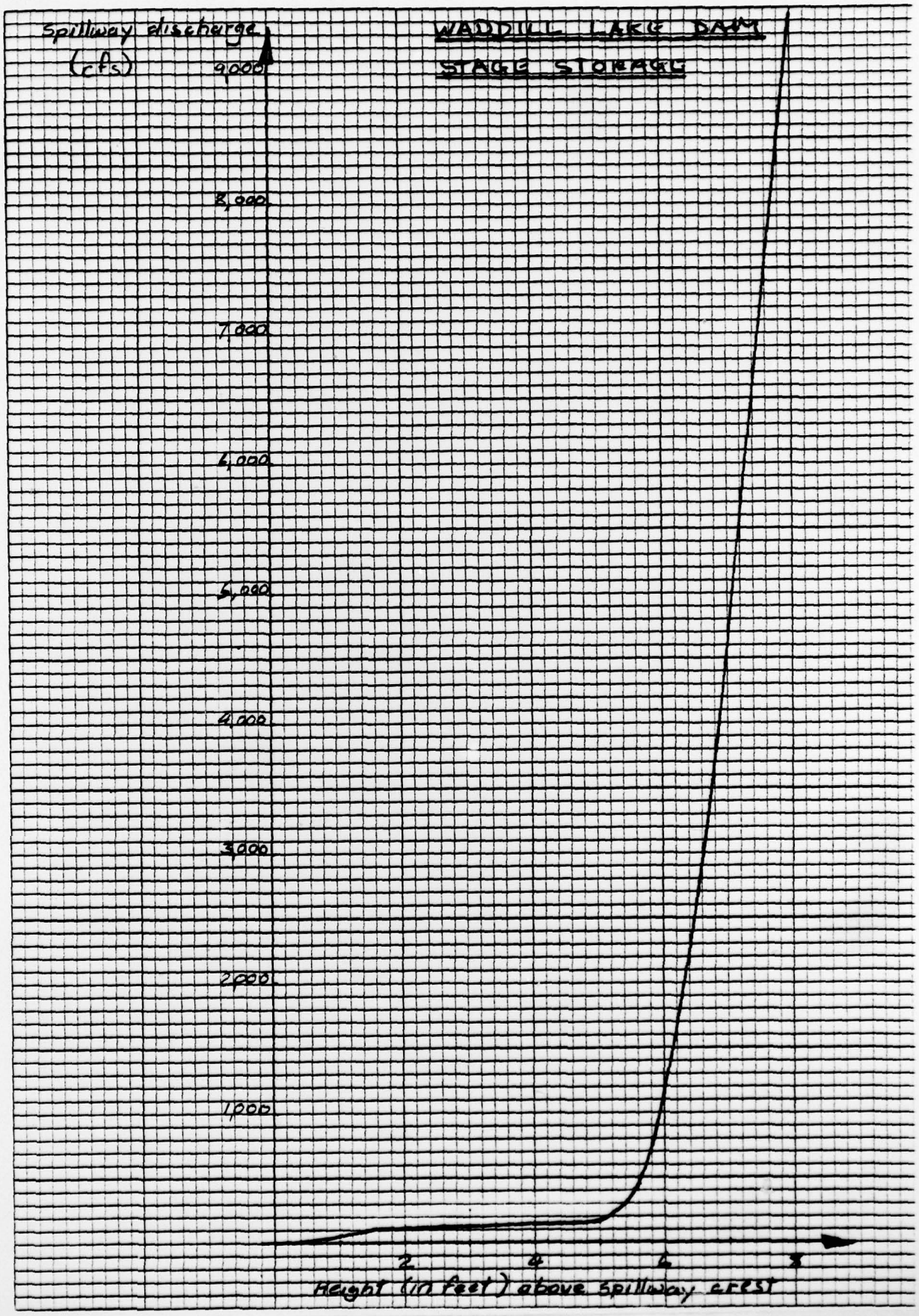
H	Q
4	101
4.5	107
5	113
6	124
7	134
8	143
9	152
10	160
11	168

flow over dam $L = 800'$

H	c	Q
0.58	2.8	989
1.58	2.8	4449
2.58	2.8	9283

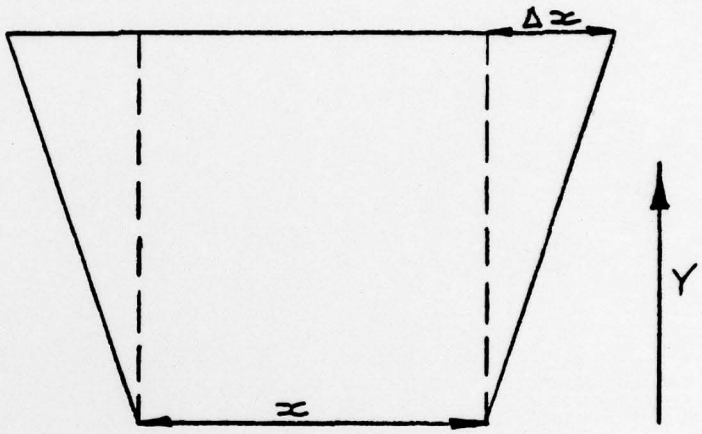
ΣQ (cfs)

H	Q
0	
1.0	55
1.5	100
2	113
3	124
4	134
5	143
6	1141
7	4609
8	9451



SURCHARGE STORAGE :

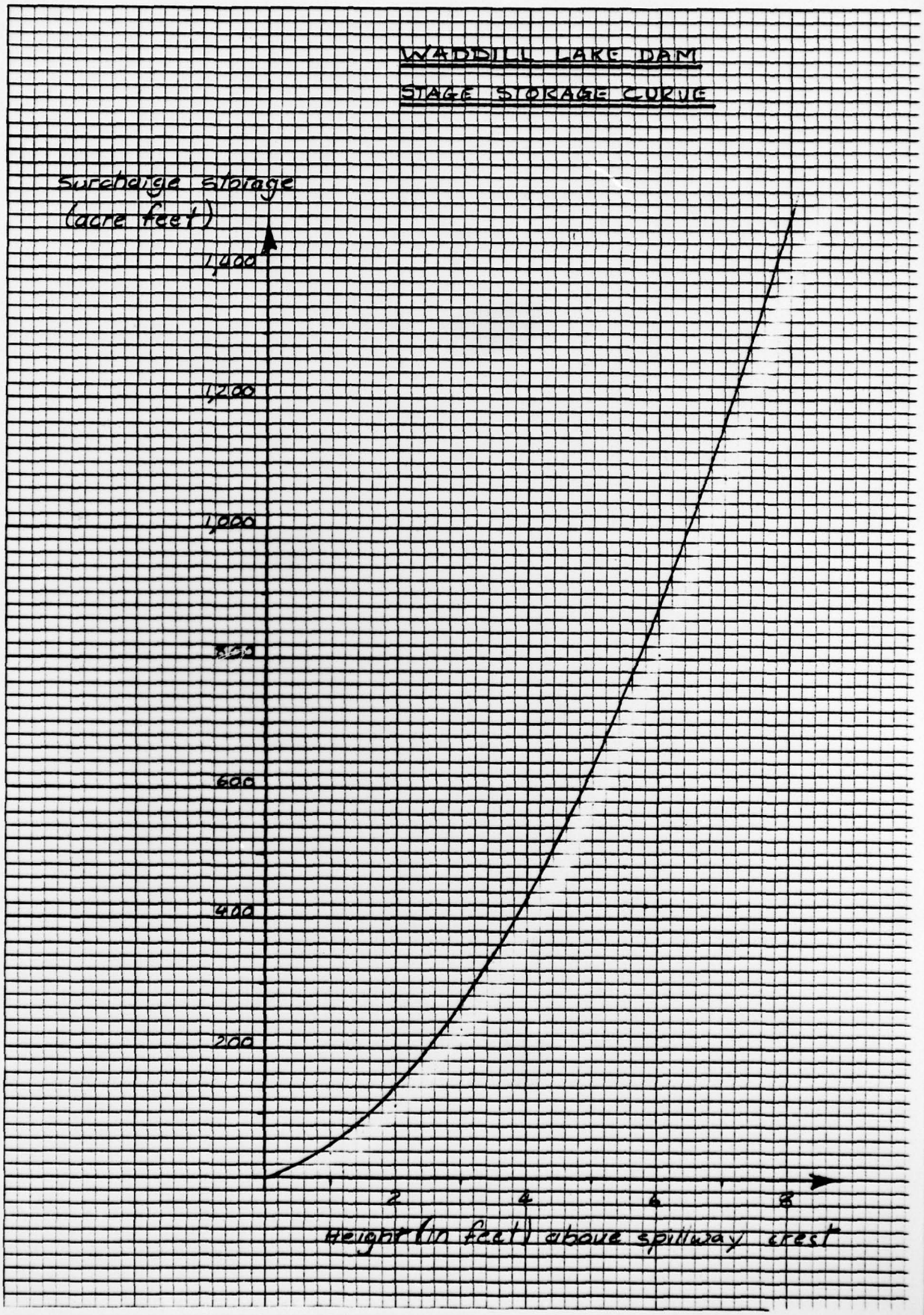
Area of lake @ normal pool = 32 acres
Area of lake @ top of dam = 239 acres
Area of 60' contour = 909 acres



Increment in volume $\Delta V = (x+\Delta x)y$

Height in feet above spillway crest	Surcharge storage (acre feet)
0	
1	51
1.5	91
2	141
3	268
4	434
5	638
6	881
7	1161
8	1480

Storage (surcharge) @ top of dam = 735 acre feet



BY D.J.M. DATE 6-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A9 OF
CHKD. BY DATE WARDILL LAKE DAM PROJECT C234
SUBJECT

GENERAL SUMMARY OF APPENDIX :

length of dam = 800 feet
Effective length of spillway = 18.8 feet

Spillway capacity @ top of dam = 147 cfs

Surcharge storage @ top of dam = 735 acre feet
Storage @ normal pool = 200 acre feet

∴ Maximum storage @ top of dam = 935 acre feet

Area of lake @ normal pool = 32 acres
Area of lake @ top of dam = 229 acres

Drainage area = 3 square miles

BY D.J.M. DATE 7-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A10 OF
CHKD. BY ____ DATE ____ WADRILL LAKE DAM PROJECT C234
SUBJECT Approximate drawdown calculations

Available head for drawdown ≃ 5'

Storage @ normal pool ≃ 200 acre-feet

Assume drawdown in 2 stages with no inflow and no tailwater

Stage 1)

$H = 3.75'$

$Q \simeq 24 cfs$

$\therefore$ time $\simeq \frac{200 \times 43560}{2 \times 24 \times 3600}$

$= 50.4$ hours

Stage 2)

$H = 1.25'$

$Q = 14 cfs$

$\therefore$ time $\simeq \frac{200 \times 43560}{2 \times 14 \times 3600}$

$= 86.4$ hours

Σ time $= (86.4 + 50.4)/24$

$= 5.7$ days

Say 6 days

BY D.J.M. DATE _____ **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. All OF _____

CHKD. BY _____ DATE _____ WADDILL LAKE DAM PROJECT C-234

SUBJECT _____

WADDILL LAKE DAM
BY D.J.M.
JUNE 27 1979

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	0	15	0	0	0	0	0	0	0

JOPER	NWT
3	0

********* ********* ********* ********* *********

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	-1	3.00	0.0	3.00	0.0	0.0	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
24	0.0	0.0	0.0

PRECIP PATTERN

0.06	0.06	0.06	0.07	0.08	0.09	0.11	0.14	0.30	0.30
0.70	1.70	0.40	0.30	0.16	0.11	0.09	0.09	0.07	0.07
0.06	0.06	0.06	0.06						

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.50	0.10	0.0	0.0

GIVEN UNIT GRAPH, NUMGG= 13

281.	1053.	1720.	1597.	1141.	720.	474.	298.	193.	123.
81.	53.	35.							

UNIT GRAPH TOTALS 7771. CFS OR 1.00 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.0 QRCSN= 0.0 RTIOR= 1.00

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.06	0.00	0.
2	0.06	0.00	0.
3	0.06	0.00	0.
4	0.07	0.00	0.
5	0.08	0.00	0.
6	0.09	0.00	0.
7	0.11	0.02	7.
8	0.14	0.11	57.
9	0.30	0.27	238.

10	0.30	0.27	602.
11	0.70	0.67	1162.
12	1.70	1.67	2242.
13	0.40	0.37	3877.
14	0.30	0.27	5004.
15	0.16	0.13	4785.
16	0.11	0.08	3872.
17	0.09	0.06	2884.
18	0.09	0.06	2125.
19	0.07	0.05	1551.
20	0.07	0.05	1160.
21	0.06	0.04	878.
22	0.06	0.04	681.
23	0.06	0.04	536.
24	0.06	0.04	431.
25	0.0	0.0	328.
26	0.0	0.0	260.
27	0.0	0.0	182.
28	0.0	0.0	118.
29	0.0	0.0	74.
30	0.0	0.0	46.
31	0.0	0.0	28.
32	0.0	0.0	17.
33	0.0	0.0	10.
34	0.0	0.0	6.
35	0.0	0.0	3.
36	0.0	0.0	1.
37	0.0	0.0	0.
38	0.0	0.0	0.
39	0.0	0.0	0.
40	0.0	0.0	0.
41	0.0	0.0	0.
42	0.0	0.0	0.
43	0.0	0.0	0.
44	0.0	0.0	0.
45	0.0	0.0	0.
46	0.0	0.0	0.
47	0.0	0.0	0.
48	0.0	0.0	0.
49	0.0	0.0	0.
50	0.0	0.0	0.
51	0.0	0.0	0.
52	0.0	0.0	0.
53	0.0	0.0	0.
54	0.0	0.0	0.
55	0.0	0.0	0.
56	0.0	0.0	0.
57	0.0	0.0	0.
58	0.0	0.0	0.
59	0.0	0.0	0.
60	0.0	0.0	0.
61	0.0	0.0	0.
62	0.0	0.0	0.
63	0.0	0.0	0.
64	0.0	0.0	0.
65	0.0	0.0	0.
66	0.0	0.0	0.
67	0.0	0.0	0.
68	0.0	0.0	0.
69	0.0	0.0	0.
70	0.0	0.0	0.

71	0.0	0.0	0.
72	0.0	0.0	0.
73	0.0	0.0	0.
74	0.0	0.0	0.
75	0.0	0.0	0.
76	0.0	0.0	0.
77	0.0	0.0	0.
78	0.0	0.0	0.
79	0.0	0.0	0.
80	0.0	0.0	0.
81	0.0	0.0	0.
82	0.0	0.0	0.
83	0.0	0.0	0.
84	0.0	0.0	0.
85	0.0	0.0	0.
86	0.0	0.0	0.
87	0.0	0.0	0.
88	0.0	0.0	0.
89	0.0	0.0	0.
90	0.0	0.0	0.
91	0.0	0.0	0.
92	0.0	0.0	0.
93	0.0	0.0	0.
94	0.0	0.0	0.
95	0.0	0.0	0.
96	0.0	0.0	0.
97	0.0	0.0	0.
98	0.0	0.0	0.
99	0.0	0.0	0.
100	0.0	0.0	0.
SUM	5.20	4.24	33165.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5004.	1380.	345.	332.	33168.
INCHES		4.28	4.29	4.29	4.29
AC-FT		685.	686.	686.	686.

HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	0.

STORAGE=	0.	51.	91.	141.	268.	434.	638.	881.	1161.	1480.
OUTFLOW=	0.	55.	100.	113.	124.	134.	143.	1141.	4609.	9451.

TIME	EOP STOR	AVG IN	EOP OUT
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.

LOUIS BERGER & ASSOCIATES INC.

WADDILL LAKE DAM

4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	3.	0.
8	1.	32.	1.
9	4.	147.	4.
10	12.	420.	13.
11	30.	882.	32.
12	64.	1702.	70.
13	125.	3059.	109.
14	215.	4441.	119.
15	313.	4895.	127.
16	400.	4329.	132.
17	467.	3378.	135.
18	516.	2505.	138.
19	551.	1838.	139.
20	576.	1356.	140.
21	595.	1019.	141.
22	608.	780.	142.
23	617.	609.	142.
24	624.	484.	142.
25	629.	379.	143.
26	632.	294.	143.
27	634.	221.	143.
28	634.	150.	143.
29	633.	96.	143.
30	632.	60.	143.
31	629.	37.	143.
32	627.	23.	143.
33	624.	14.	142.
34	621.	8.	142.
35	619.	5.	142.
36	616.	2.	142.
37	613.	1.	142.
38	610.	0.	142.
39	607.	0.	142.
40	604.	0.	142.
41	601.	0.	141.
42	598.	0.	141.
43	595.	0.	141.
44	592.	0.	141.
45	589.	0.	141.
46	587.	0.	141.
47	584.	0.	141.
48	581.	0.	140.
49	578.	0.	140.
50	575.	0.	140.
51	572.	0.	140.
52	569.	0.	140.
53	566.	0.	140.
54	563.	0.	140.
55	560.	0.	140.
56	558.	0.	139.
57	555.	0.	139.
58	552.	0.	139.
59	549.	0.	139.
60	546.	0.	139.
61	543.	0.	139.
62	540.	0.	139.
63	537.	0.	139.
64	535.	0.	138.

	65	532.	0.	138.
	66	529.	0.	138.
	67	526.	0.	138.
	68	523.	0.	138.
	69	520.	0.	138.
	70	517.	0.	138.
	71	515.	0.	138.
	72	512.	0.	137.
	73	509.	0.	137.
	74	506.	0.	137.
	75	503.	0.	137.
	76	500.	0.	137.
	77	498.	0.	137.
	78	495.	0.	137.
	79	492.	0.	137.
	80	489.	0.	136.
	81	486.	0.	136.
	82	484.	0.	136.
	83	481.	0.	136.
	84	478.	0.	136.
	85	475.	0.	136.
	86	472.	0.	136.
	87	470.	0.	136.
	88	467.	0.	135.
	89	464.	0.	135.
	90	461.	0.	135.
	91	458.	0.	135.
	92	456.	0.	135.
	93	453.	0.	135.
	94	450.	0.	135.
	95	447.	0.	135.
	96	444.	0.	134.
	97	442.	0.	134.
	98	439.	0.	134.
	99	436.	0.	134.
	100	433.	0.	134.
	SUM			12262.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	143.	142.	128.	123.	12262.
INCHES		0.44	1.58	1.58	1.58
AC-FT		70.	253.	253.	253.

********** ********** **********

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	5004.	1380.	345.	332.	3.00
ROUTED TO	1	143.	142.	128.	123.	3.00